Schedule and Documentation

James Mills

Project Direction

- Preliminary Stages of Project
  - Assemble Project Management team
  - Fast Track Effort
    - Set up flexible system to quickly and accurately manage change and set up controls
    - Assemble experienced team
  - Work Breakdown Structure
  - Organization Structure
  - Establish WBS Level 2 Management (and if possible Level 3 and if lucky to Level 4)
  - Establish straightforward lines of communication to BNL Senior Management
- Weekly/bi-weekly meetings
  - Project Management status meeting with senior BNL management and project/technical advisory committee
  - sPHENIX Project Management meeting
  - Subsystem technical and status meetings
  - Engineering team - status meeting
  - Science status and coordination meeting
  - Engineering/Technical coordination meeting

Project Documentation

- ✓ Work Breakdown Structure
- ✓ PM Organization Structure
- ✓ High Level Top's Down Schedule (Anticipated CD Authorization)
- ✓ Preliminary Bottom's-Up Schedule
- ✓ Recommendation Tracking System (Comment Resolution Book)
- ✓ Preliminary Basis of Estimate Document
- ✓ Preliminary WBS Dictionary
- ✓ Draft NEPA Evaluation Document (Met with ESH and Draft by 12/31/15)
- ✓ PCDR
- ✓ Preliminary Contingency and Risk Analysis Document
- ✓ Integration (Detector Envelope) Drawing
- ✓ Preliminary Q/A and Project Configuration Management and Controls
- ✓ Preliminary Hazard Analysis Report (started)

Project Management Documentation

- Work Breakdown Structure

On-Project →

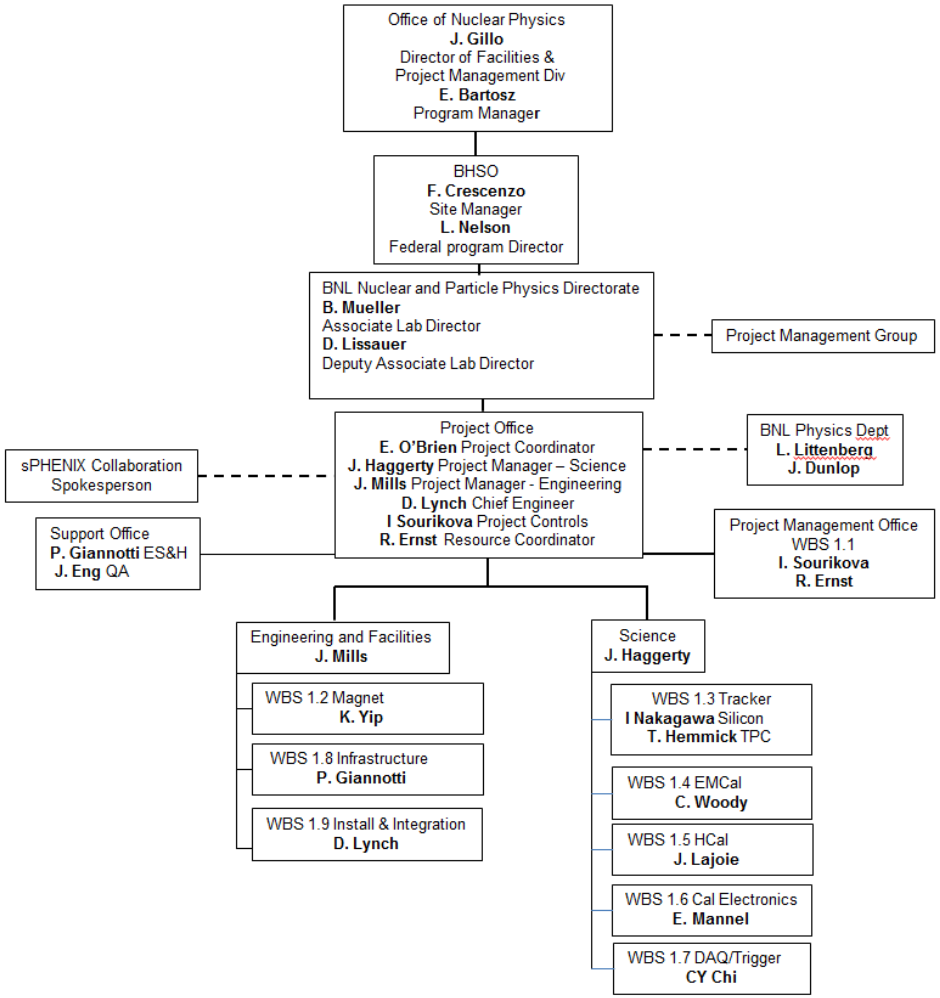
1. sPHENIX Design, Production, Commissioning
1.01 Project Management
1.02 Magnet
1.03 Tracker (not included in DOE TPC)
1.04 EMCal
1.05 HCal
1.06 Calorimeter Electronics
1.07 DAQ/Trigger
1.08 Infrastructure
1.09 Installation/Integration

Not On-Project →

2. sPHENIX Preconceptual Activities
2.01 Decommissioning
2.02 Magnet Acceptance Testing
2.03 Tracker Generic R&D and Preconceptual Design
2.04 EMCal Generic R&D and Preconceptual Design
2.05 HCal Generic R&D and Preconceptual Design
2.06 Calorimeter Electronics R&D and Preconceptual Design
2.07 DAQ/Trigger generic R&D and Preconceptual Design
2.08 Infrastructure Preconceptual
2.09 Installation and Integration Preconceptual

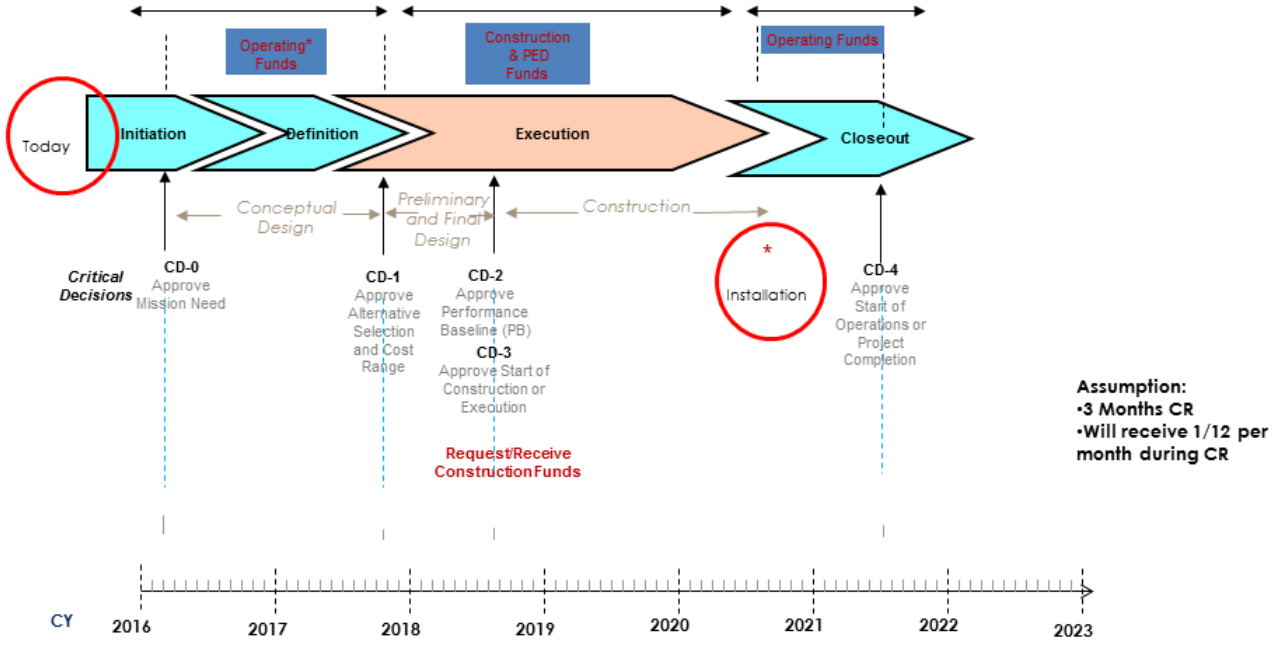
Project Management Documentation

Project Organization Structure



Project Schedule Documentation

- High Level Top's-Down Milestones



•Operating Funds are used for conceptual design between CD-0 and CD-1. Operating funds may also be used prior to CD-4 for R&D, NEPA, D&D, ES&H, transition, startup, and training costs. Non-federal funds from other sources that are considered capital funds and are included in the "Total line item cost" as OPC.

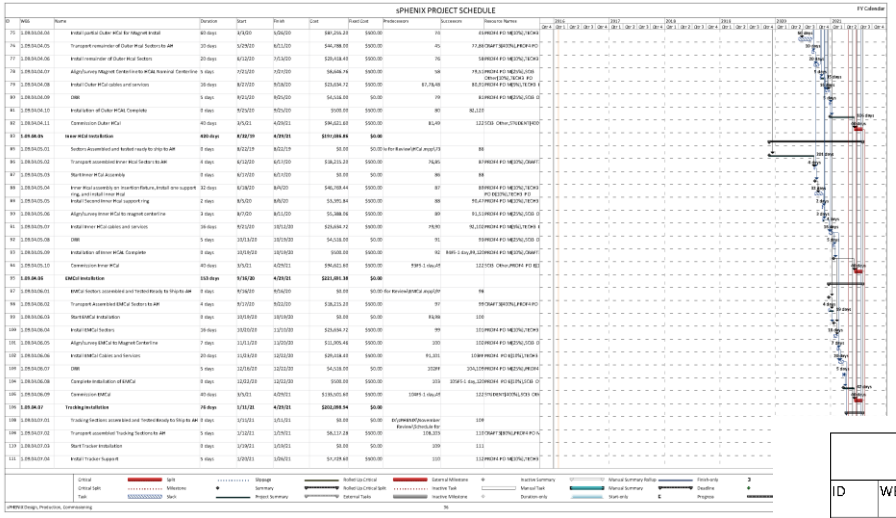
•Good Practice—For the first year that TEC is requested, ensure that OPC is also requested for that year. The OPC will allow the project to continue in a long CR until TEC is available and new starts are allowed.

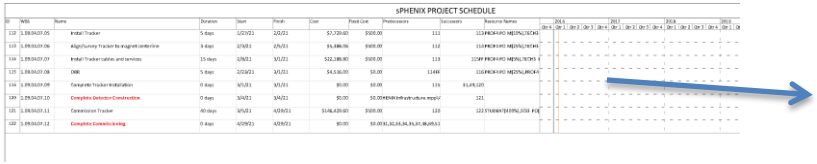
•MIE funds are more flexible than Line Items. Moving OPC to TEC or vice versa is much easier than for Line-Item reprogramming since MIE funds are "batched."

•New Start is defined as the first use/appropriation of any TEC funds (including TEC PED) for both line items and MIEs project.

Project Schedule Documentation

- Preliminary Project Schedule – Detailed Bottom's-Up Schedule





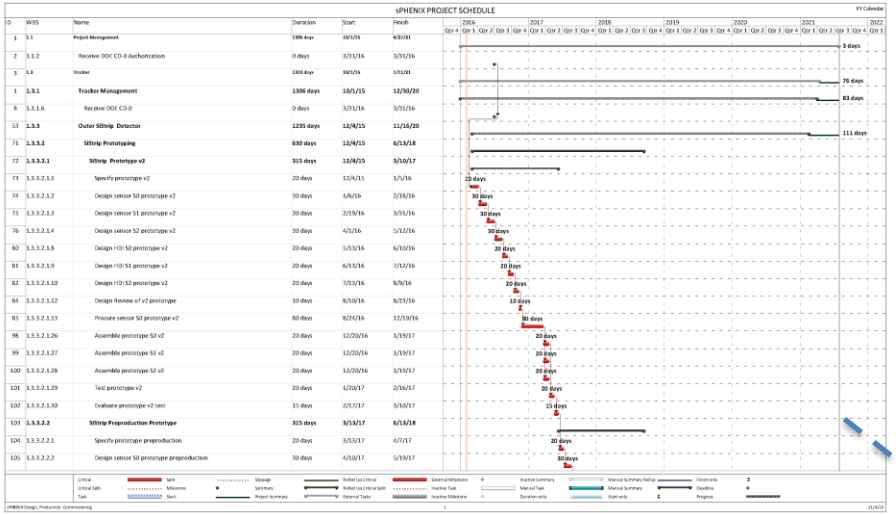
- MS Project 2010 Schedule
- 1600+ Lines
- Predecessors/Successors
- Critical Path/Milestones
- Subsystem files merged into Master File

ID	WBS	Name	Duration	Start	Finish	C
112	1.09.04.07.05	Install Tracker	5 days	1/27/21	2/2/21	
113	1.09.04.07.06	Align/survey Tracker to magnet centerline	3 days	2/3/21	2/5/21	
114	1.09.04.07.07	Install Tracker cables and services	15 days	2/8/21	3/1/21	
115	1.09.04.07.08	ORR	5 days	2/23/21	3/1/21	
116	1.09.04.07.09	Complete Tracker Installation	0 days	3/1/21	3/1/21	
120	1.09.04.07.10	Complete Detector Construction	0 days	3/4/21	3/4/21	
121	1.09.04.07.11	Commission Tracker	40 days	3/5/21	4/29/21	
122	1.09.04.07.12	Complete Commissioning	0 days	4/29/21	4/29/21	

- M&S is considered Fixed Cost and is accrued at the start of a task.
- Labor is based on an hourly rate and is prorated across the task duration.

Project Schedule Documentation

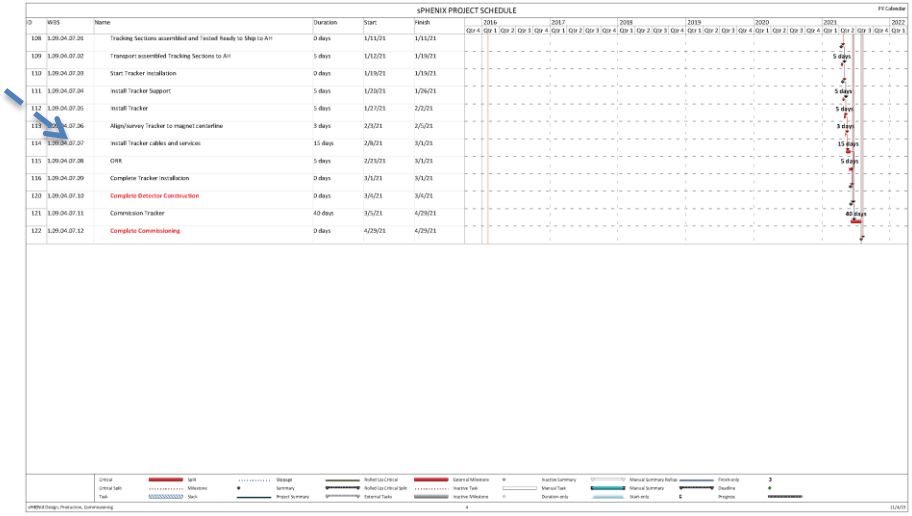
- Preliminary Schedule – Critical Path*



Tracker Production -->

Tracker Installation -->

Subsystem Commissioning



Schedule Float

Cradle Baseplate – 190d

Production Outer Hcal - 11d

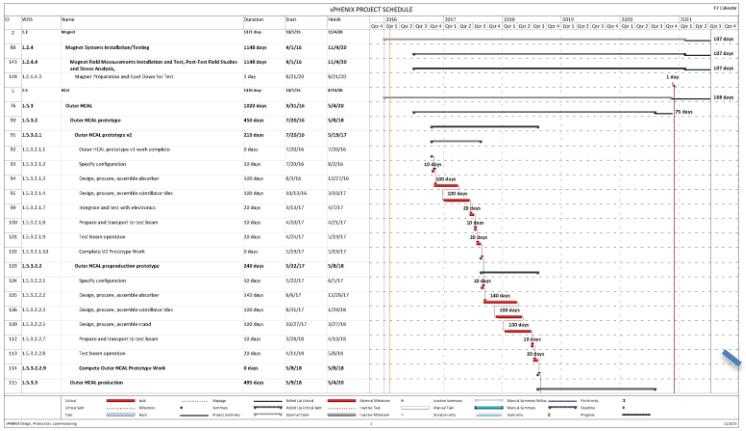
Production Inner Hcal – 56d

Production EMCal – 153d

* Critical Path shown has redundant, parallel - equal duration tasks removed for clarity.

Project Schedule Documentation

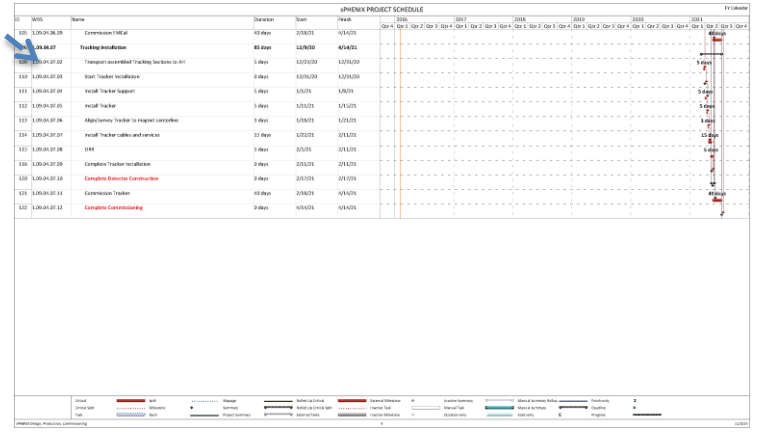
- Preliminary Schedule – Secondary Critical Path



Outer HCal Production -->

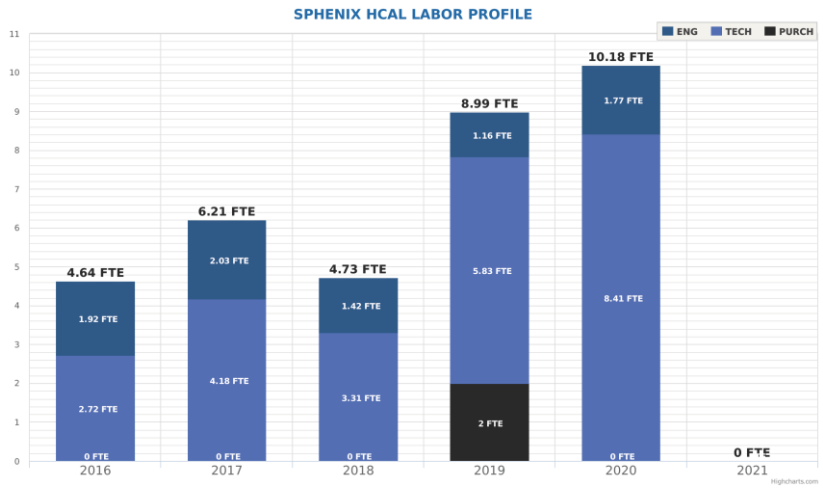
Detector Construction
(All Subsystems) -->

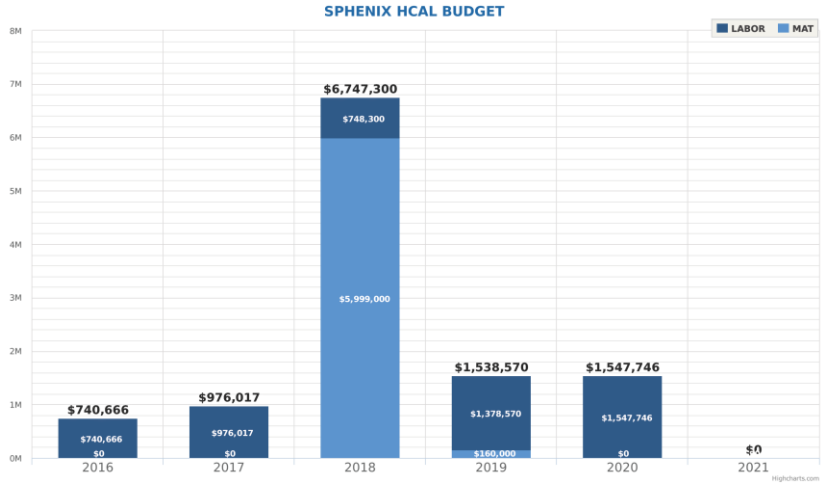
Subsystem
Commissioning

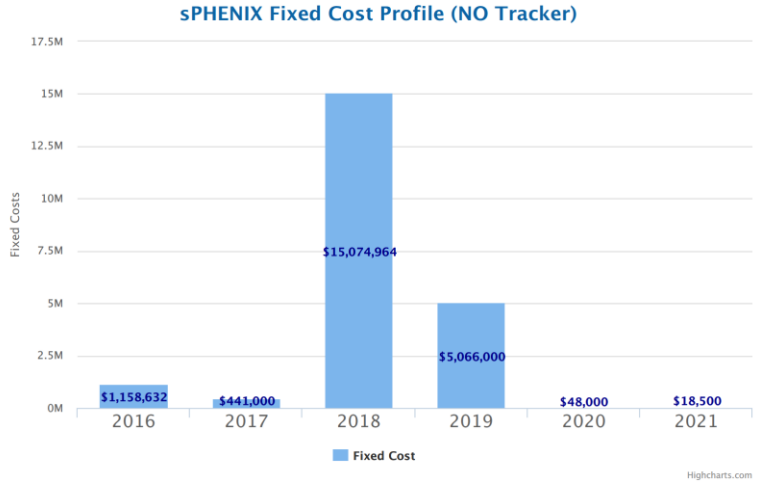


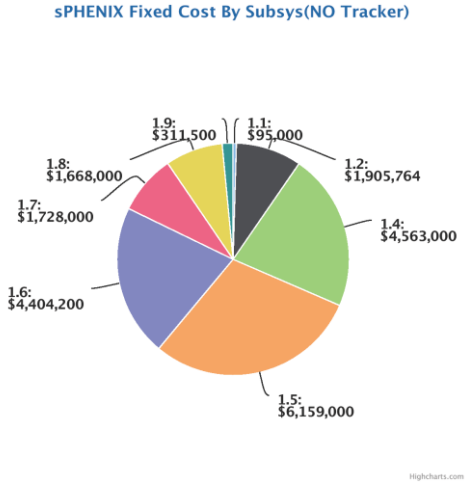
Project Schedule Documentation

- Preliminary Schedule – Labor Breakdown (HCal Example)









Project Documentation

- Recommendation Tracking System (Comment Resolution Book)

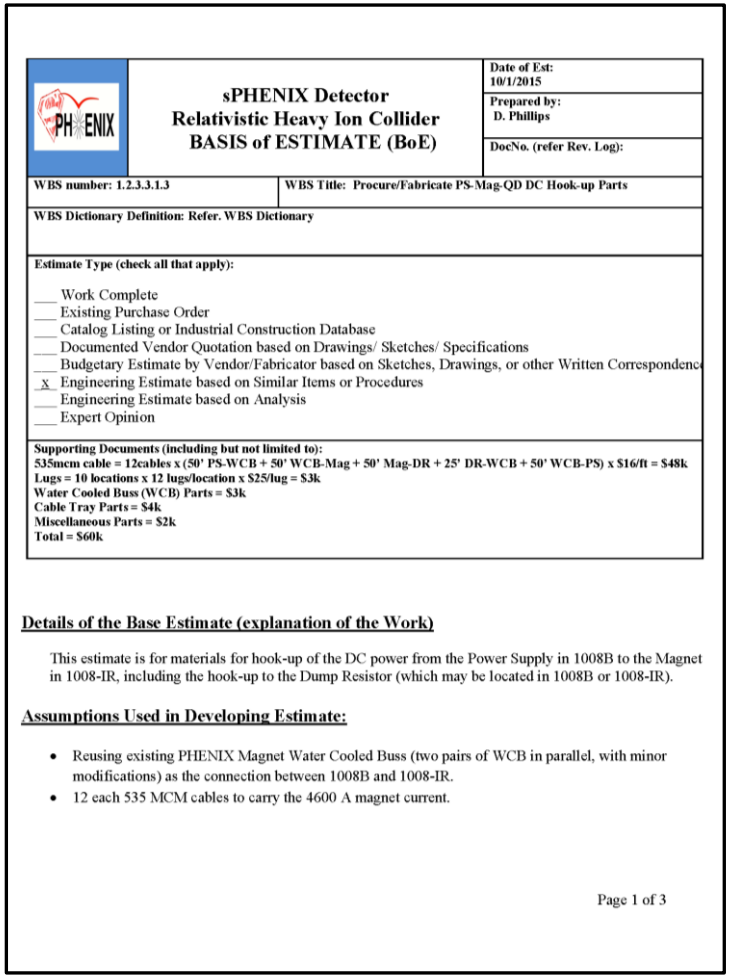
sPHENIX Recommendations Tracking System

Click on column header to sort. Click on recommendation id to edit.

ID	Fiscal Year	Level	Status	WBS	WBS name	Review	Recommendation	Originator	Assigned on	Responsible	Resolution Comment	Resolved on	Ack via
1	2015	Internal	Closed	1.2	Magnet	Magnet Review	Continue with plan for the 100A test (or as high current as possible with the same instrumentation) at a site suitable for 1000A or full field test with a strong recommendation to perform full field test prior to DOE review	P. Pile, Chair	2014-12-16	K. Yip	Sphenix has developed a plan for performing Low Field/High Field testing in B9112. Presentation of this plan to lab senior management will be done by 4/30/2015	2015-04-07	
2	2015	Internal	open	1.2	Magnet	Magnet Review	Conduct a study of requirements for a full field test; simple return yoke design, power supply and quench protection.	P. Pile, Chair	2014-12-16	K. Yip	Design of a yoke return for a full field test was performed. Detail design to follow.	2015-04-07	
3	2015	Internal	open	1.2	Magnet	Magnet Review	Perform a full field test, if possible, in bldg. 912 before the magnet is moved to 1008. 2	P. Pile, Chair	2014-12-16	K. Yip	Yes, this is being addressed (see No. 1 above).	2015-04-07	
4	2015	Internal	Closed	1.2	Magnet	Magnet Review	Resolution of management team issues for installation and testing of the magnet in 1008 will require C-AD management and ALD involvement as support for this effort will come at the expense of ongoing projects. Recommendation: Work with the ALD and C-AD management to solve this problem ASAP.	P. Pile, Chair	2014-12-16	E. O'Brien/J. Mills	Level 2 Manager for Manget has been assigned by CA.	2015-04-07	
							Installation and testing of the Magnet in the						

Project Documentation

- Preliminary Basis of Estimate Document



sPHENIX Detector
Relativistic Heavy Ion Collider
BASIS of ESTIMATE (BoE)

Date of Est: 10/1/2015	
Prepared by: D. Phillips	
DocNo. (refer Rev. Log):	

WBS number: 1.2.3.3.1.3 — **WBS Title: Procure/Fabricate PS-Mag-QD DC Hook-up Parts**

WBS Dictionary Definition: Refer. WBS Dictionary

Estimate Type (check all that apply):

___ Work Complete
___ Existing Purchase Order
___ Catalog Listing or Industrial Construction Database
___ Documented Vendor Quotation based on Drawings/ Sketches/ Specifications
___ Budgetary Estimate by Vendor/Fabricator based on Sketches, Drawings, or other Written Correspondence
_x_ Engineering Estimate based on Similar Items or Procedures
___ Engineering Estimate based on Analysis
___ Expert Opinion

Supporting Documents (including but not limited to):
535mcm cable = 12cables x (50' PS-WCB + 50' WCB-Mag + 50' Mag-DR + 25' DR-WCB + 50' WCB-PS) x $16/ft = $48k
Lugs = 10 locations x 12 lugs/location x $25/lug = $3k
Water Cooled Buss (WCB) Parts = $3k
Cable Tray Parts = $4k
Miscellaneous Parts = $2k
Total = $60k

Details of the Base Estimate (explanation of the Work)

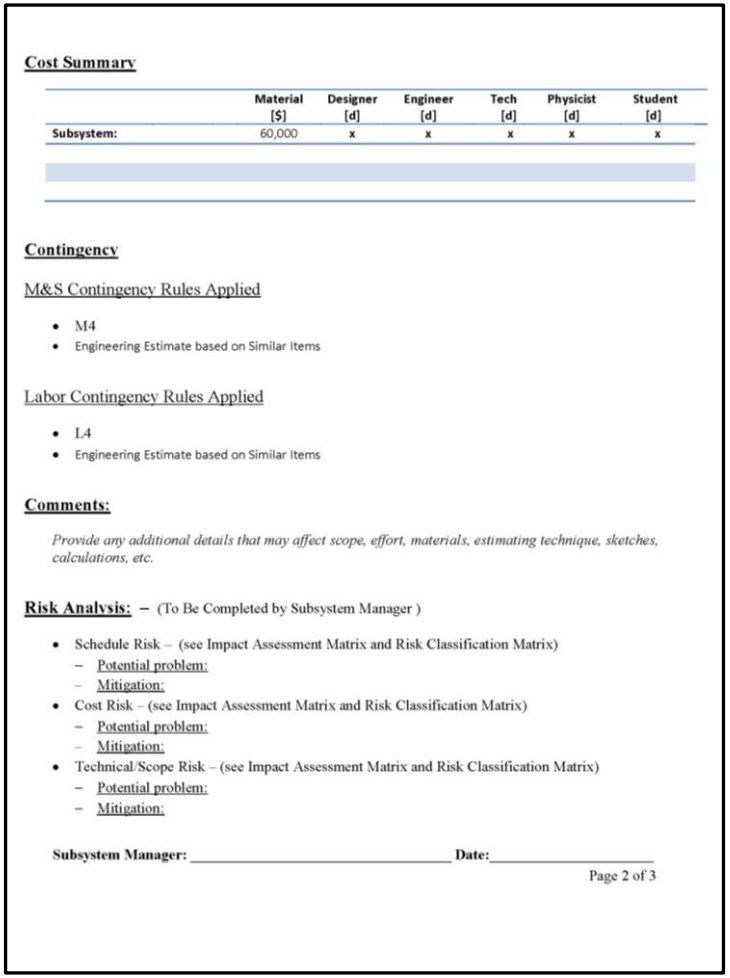
This estimate is for materials for hook-up of the DC power from the Power Supply in 1008B to the Magnet in 1008-IR, including the hook-up to the Dump Resistor (which may be located in 1008B or 1008-IR).

Assumptions Used in Developing Estimate:

- Reusing existing PHENIX Magnet Water Cooled Buss (two pairs of WCB in parallel, with minor modifications) as the connection between 1008B and 1008-IR.
- 12 each 535 MCM cables to carry the 4600 A magnet current.

Page 1 of 3

Page 1



Cost Summary

	Material [$]	Designer [d]	Engineer [d]	Tech [d]	Physicist [d]	Student [d]
Subsystem:	60,000	x	x	x	x	x

Contingency

M&S Contingency Rules Applied

- M4
- Engineering Estimate based on Similar Items

Labor Contingency Rules Applied

- L4
- Engineering Estimate based on Similar Items

Comments:

Provide any additional details that may affect scope, effort, materials, estimating technique, sketches, calculations, etc.

Risk Analysis: – (To Be Completed by Subsystem Manager)

- Schedule Risk – (see Impact Assessment Matrix and Risk Classification Matrix)
  - Potential problem:
  - Mitigation:
- Cost Risk – (see Impact Assessment Matrix and Risk Classification Matrix)
  - Potential problem:
  - Mitigation:
- Technical/Scope Risk – (see Impact Assessment Matrix and Risk Classification Matrix)
  - Potential problem:
  - Mitigation:

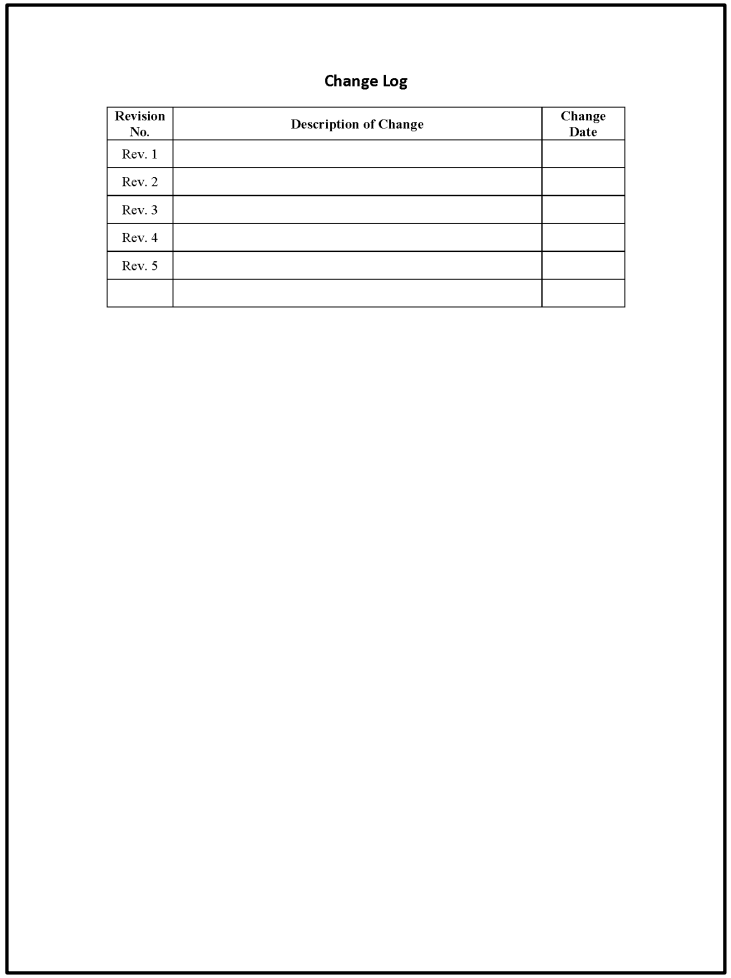
Subsystem Manager: _____ **Date:** _____

Page 2 of 3

Page 2

Project Documentation

- Preliminary Basis of Estimate Document



Change Log

Revision No.	Description of Change	Change Date
Rev. 1		
Rev. 2		
Rev. 3		
Rev. 4		
Rev. 5		

Page 3

1. Project Title:	2. Date:	3: Person Responsible
SPHENIX	02/17/2015	M. Anerella

4. WBS Element Code	5. WBS Element Title
1.02.04.01 Magnet Mechanical Coil/Core Modifications	Installation/Testing

6. Index Line Number:	7. Revision Number and Authorization:	8: Rev. Date

9. Approved Changes

9. Element Task Description

COST CONTENT:

The costs associated with this item are for both labor and materials. The labor is the effort by engineers, technicians and other personnel associated with the preparation of the magnet and valve box for shipment from Building 912 to the experimental hall, and installation, reassembly and alignment of the magnet as described in the infrastructure design WBS dictionary entry. Material costs are for consumables used in the installation and alignment of the magnet. All labor and material estimates for this are based on engineering estimates.

TECHNICAL SCOPE:

This item includes all tasks required for disassembly of the valve box from the magnet, preparation of the magnet and valve box for shipment from Building 912 to the experimental hall, and installation, reassembly and alignment of the magnet as described in the infrastructure design WBS dictionary entry.

Mechanical support structures (those structural components of the sPHENIX detector which integrate and structurally support the detector subsystem that comprise the magnet support mounting and associated alignment features).

WORK STATEMENT:

The efforts required to complete this WBS item are described for the various subtasks as follows:

Magnet System Installation and Alignment - This task encompasses disassembly of the valve box from the magnet in Building 912, preparation of magnet and valve box for transport to the experimental hall, reassembly of the valve box to the magnet in the experimental hall, in situ adjustments and inspections of the magnet and alignment of the magnet to the calorimeter.

Deliverable: Magnet installed and aligned to calorimeter, ready to be powered after upper calorimeter installation.

Project Documentation

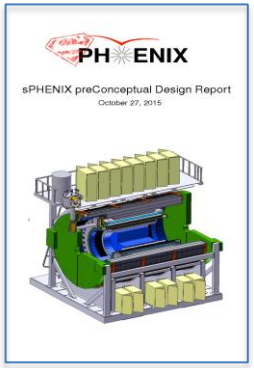
Preliminary WBS Dictionary

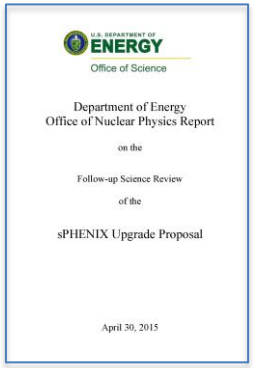
WBS Dictionary to Level 4

WBS 1.02.04.01 Dictionary

Project Documentation

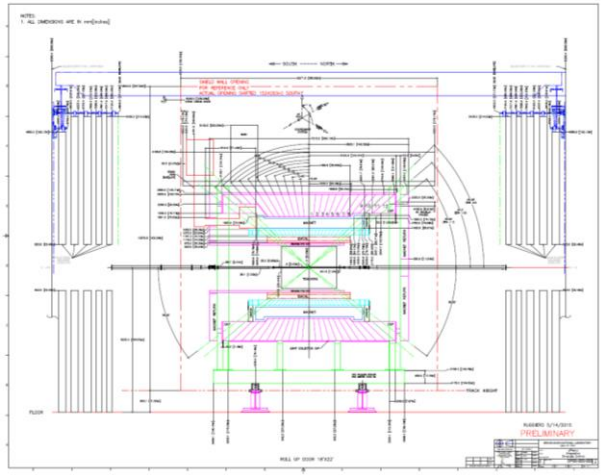
- PCDR/Science Report – Defines Science Requirements, and how they relate and help define Technical Requirements (Indico Site)





- Integration Envelope Drawing/Document
  - Define (early in project) detector subsystem envelopes and stay clear zones.
  - Establish reasonable buffer between components (owned by project management).
  - Establish interconnect regions for attachments and supports.

Rich Ruggiero to discuss in Breakout Presentation



Project Documentation

Preliminary Contingency and Risk Analysis Document

Irina Sourikova to discuss in Breakout Presentation

- Risk - Top-Down (Project Level and Subsystem Manager Level)
- Contingency
  - Top-Down-Global (for this review)
  - Bottoms-up Task Based Contingency Evaluation
    - ATLAS/DUNE - Labor/Materials Contingency
    - BNL SBMS – Technical/Cost/Schedule Contingency

Preliminary Q/A and Project Configuration Management Plan

Jack Eng to discuss in Breakout Presentation

- Bring Quality Concepts into project
  - Link BNL Quality Office Requirements to project
  - Link Standards Based Management System Requirements to Project
- Bring Configuration Management into project
  - Document Control
  - Change Control
  - Lines of Approval
  - Define Interface and Approval requirements to other participating departments and institutions.

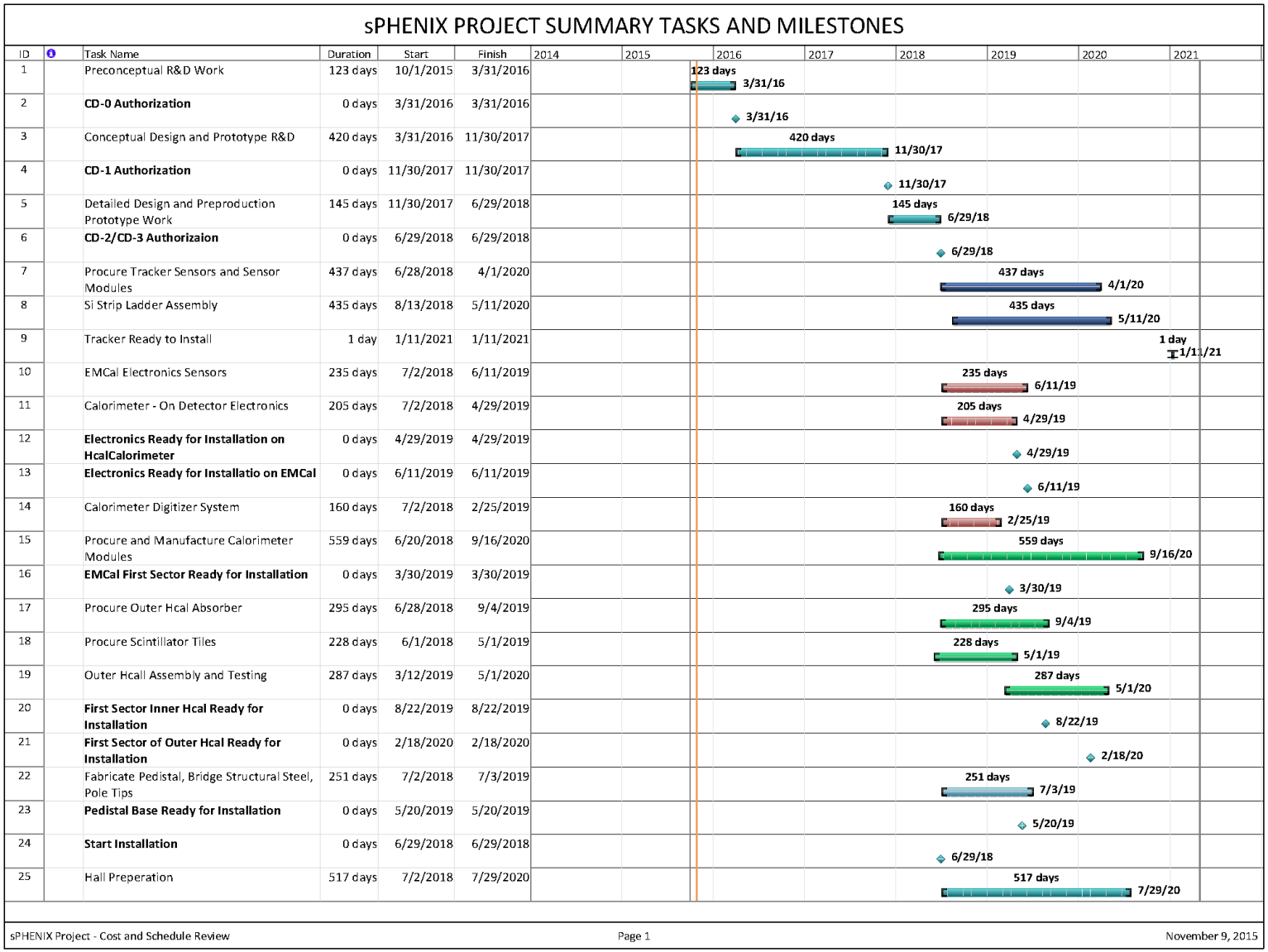
Preliminary Hazard Analysis Report

Paul Giannotti to discuss in Breakout Presentation

- Follow CA-D 2011 Safety Assessment Document (SAD)
- BNL ESH Requirements
- Safety Committees
  - Radiation Safety Committee
  - Experimental Safety Review Committee
  - Accelerator Systems Safety Review Committee
  - ALARA Committee

Back Up Slides

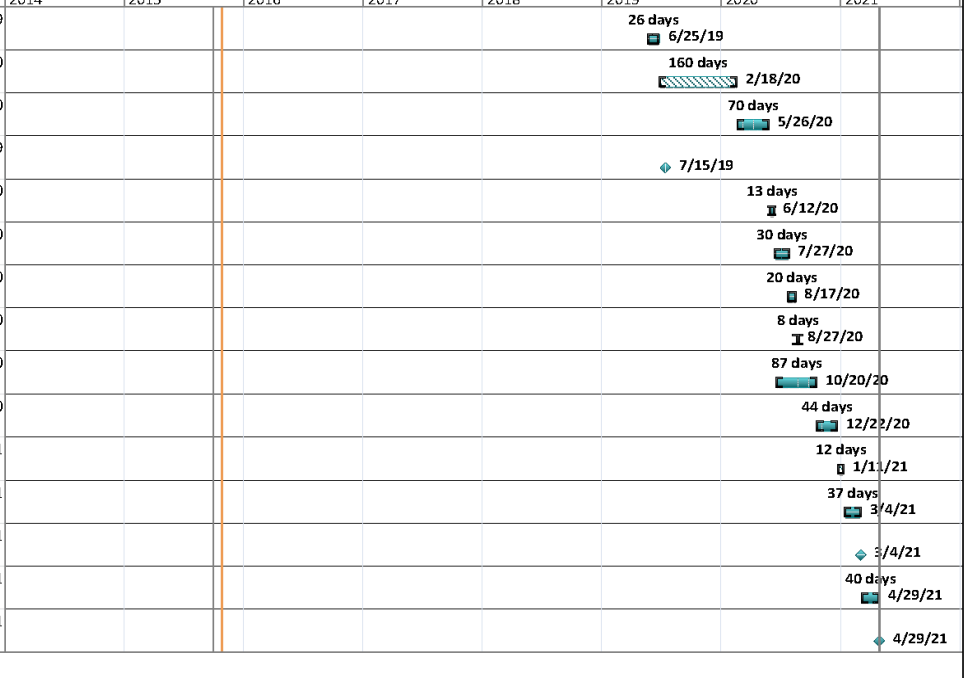
Condensed Summary Tasks and Milestones



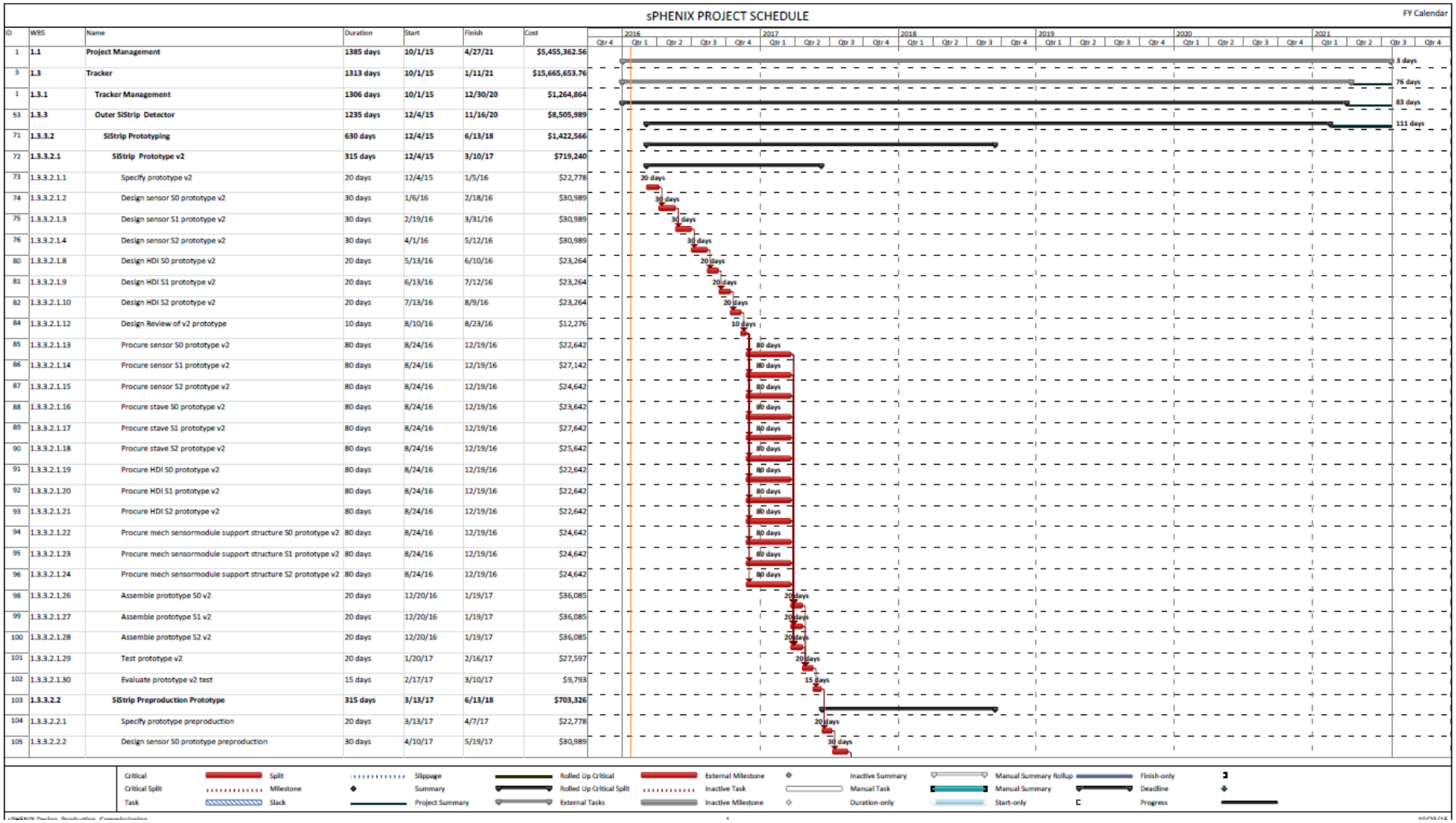
Condensed Summary Tasks and Milestones

sPHENIX PROJECT SUMMARY TASKS AND MILESTONES

ID	Task Name	Duration	Start	Finish
26	Install Pedistal Base and Upper Cradle	26 days	5/20/2019	6/25/2019
27	Awaiting First Sector Outer Hcal	160 days	6/25/2019	2/18/2020
28	Install Lower Half of Hcal	70 days	2/18/2020	5/26/2020
29	**Coil ready for delivery to Assembly Hall**	0 days	7/15/2019	7/15/2019
30	Install Coil	13 days	5/27/2020	6/12/2020
31	Install Upper Half of Outer Hcal	30 days	6/12/2020	7/27/2020
32	Reinstall Coil Valve Box in Assembly Hall	20 days	7/21/2020	8/17/2020
33	Install Pole Tips and Complete Carriage	8 days	8/18/2020	8/27/2020
34	Assemble, Prealign, and Install Inner Hcal	87 days	6/17/2020	10/20/2020
35	Install EMCal	44 days	10/19/2020	12/22/2020
36	Awaiting Tracker	12 days	12/22/2020	1/11/2021
37	Install Tracker	37 days	1/11/2021	3/4/2021
38	**Complete Construction**	0 days	3/4/2021	3/4/2021
39	Perform Commissioning	40 days	3/5/2021	4/29/2021
40	**Ready for Beam**	0 days	4/29/2021	4/29/2021

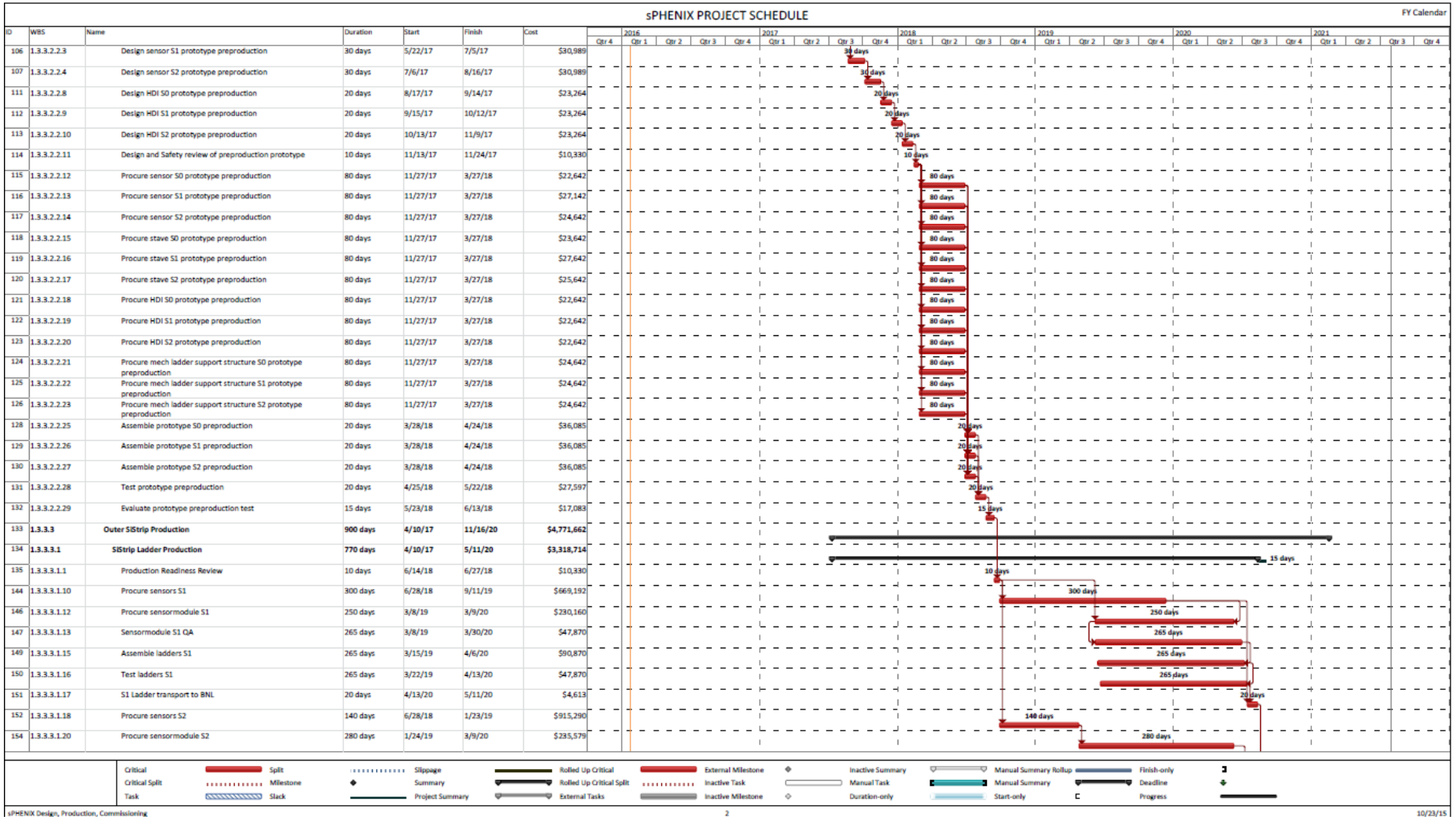


Critical Path



ID	WBS	Name	Duration	Start	Finish	Cost
1	**1.1**	**Project Management**	**1385 days**	**10/1/15**	**4/27/21**	**$5,455,362.56**
3	**1.3**	**Tracker**	**1313 days**	**10/1/15**	**1/11/21**	**$15,665,653.76**
1	**1.3.1**	**Tracker Management**	**1306 days**	**10/1/15**	**12/30/20**	**$1,264,864**
53	**1.3.3**	**Outer SiStrip Detector**	**1235 days**	**12/4/15**	**11/16/20**	**$8,505,989**
71	**1.3.3.2**	**SiStrip Prototyping**	**630 days**	**12/4/15**	**6/13/18**	**$1,422,566**
72	**1.3.3.2.1**	**SiStrip Prototype v2**	**315 days**	**12/4/15**	**3/10/17**	**$719,240**
73	1.3.3.2.1.1	Specify prototype v2	20 days	12/4/15	1/5/16	$22,778
74	1.3.3.2.1.2	Design sensor S0 prototype v2	30 days	1/6/16	2/18/16	$30,989
75	1.3.3.2.1.3	Design sensor S1 prototype v2	30 days	2/19/16	3/31/16	$30,989
76	1.3.3.2.1.4	Design sensor S2 prototype v2	30 days	4/1/16	5/12/16	$30,989
80	1.3.3.2.1.8	Design HDI S0 prototype v2	20 days	5/13/16	6/10/16	$23,264
81	1.3.3.2.1.9	Design HDI S1 prototype v2	20 days	6/13/16	7/12/16	$23,264
82	1.3.3.2.1.10	Design HDI S2 prototype v2	20 days	7/13/16	8/9/16	$23,264
84	1.3.3.2.1.12	Design Review of v2 prototype	10 days	8/10/16	8/23/16	$12,276
85	1.3.3.2.1.13	Procure sensor S0 prototype v2	80 days	8/24/16	12/19/16	$22,642
86	1.3.3.2.1.14	Procure sensor S1 prototype v2	80 days	8/24/16	12/19/16	$27,142
87	1.3.3.2.1.15	Procure sensor S2 prototype v2	80 days	8/24/16	12/19/16	$24,642
88	1.3.3.2.1.16	Procure stave S0 prototype v2	80 days	8/24/16	12/19/16	$23,642
89	1.3.3.2.1.17	Procure stave S1 prototype v2	80 days	8/24/16	12/19/16	$27,642
90	1.3.3.2.1.18	Procure stave S2 prototype v2	80 days	8/24/16	12/19/16	$25,642
91	1.3.3.2.1.19	Procure HDI S0 prototype v2	80 days	8/24/16	12/19/16	$22,642
92	1.3.3.2.1.20	Procure HDI S1 prototype v2	80 days	8/24/16	12/19/16	$22,642
93	1.3.3.2.1.21	Procure HDI S2 prototype v2	80 days	8/24/16	12/19/16	$22,642
94	1.3.3.2.1.22	Procure mech sensormodule support structure S0 prototype v2	80 days	8/24/16	12/19/16	$24,642
95	1.3.3.2.1.23	Procure mech sensormodule support structure S1 prototype v2	80 days	8/24/16	12/19/16	$24,642
96	1.3.3.2.1.24	Procure mech sensormodule support structure S2 prototype v2	80 days	8/24/16	12/19/16	$24,642
98	1.3.3.2.1.26	Assemble prototype S0 v2	20 days	12/20/16	1/19/17	$36,085
99	1.3.3.2.1.27	Assemble prototype S1 v2	20 days	12/20/16	1/19/17	$36,085
100	1.3.3.2.1.28	Assemble prototype S2 v2	20 days	12/20/16	1/19/17	$36,085
101	1.3.3.2.1.29	Test prototype v2	20 days	1/20/17	2/16/17	$27,597
102	1.3.3.2.1.30	Evaluate prototype v2 test	15 days	2/17/17	3/10/17	$9,793
103	**1.3.3.2.2**	**SiStrip Preproduction Prototype**	**315 days**	**3/13/17**	**6/13/18**	**$703,326**
104	1.3.3.2.2.1	Specify prototype preproduction	20 days	3/13/17	4/7/17	$22,778
105	1.3.3.2.2.2	Design sensor S0 prototype preproduction	30 days	4/10/17	5/19/17	$30,989

Critical Path

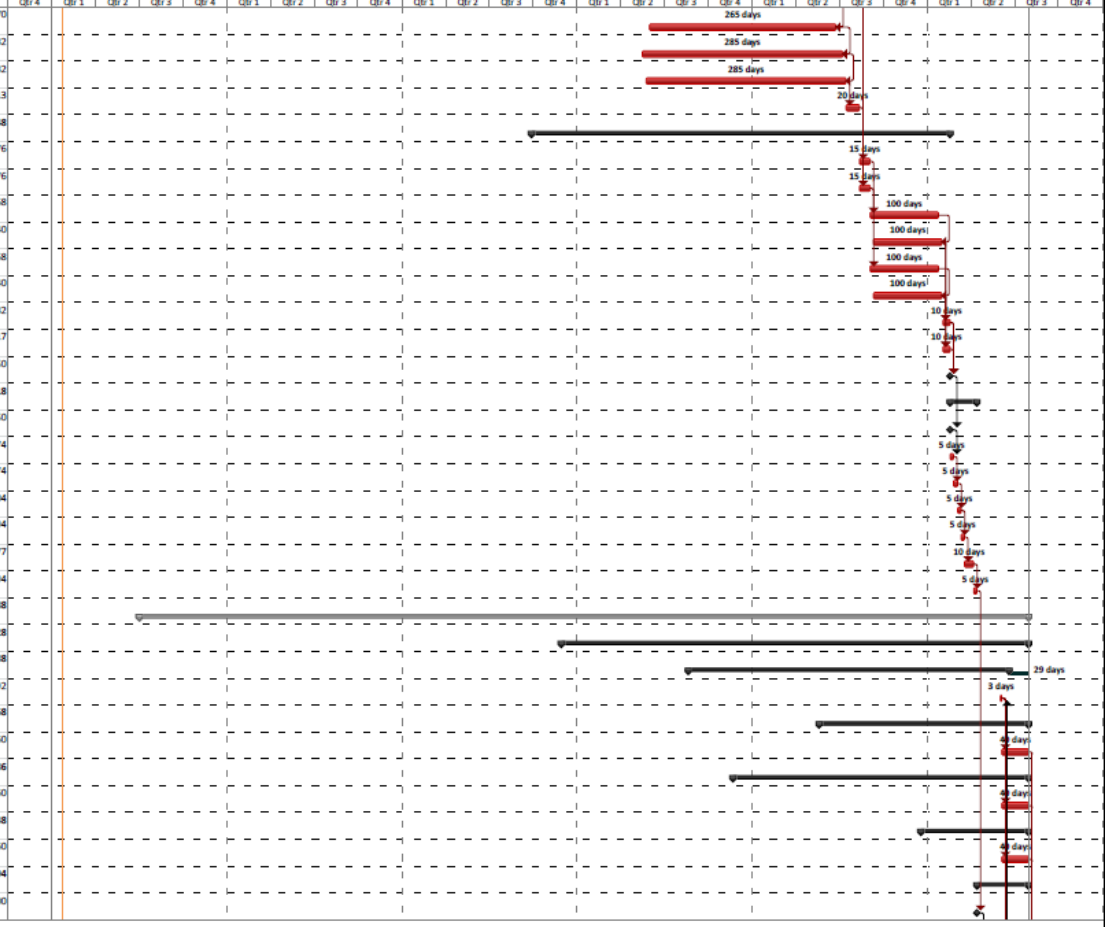


Critical Path

sPHENIX PROJECT SCHEDULE

FY Calendar

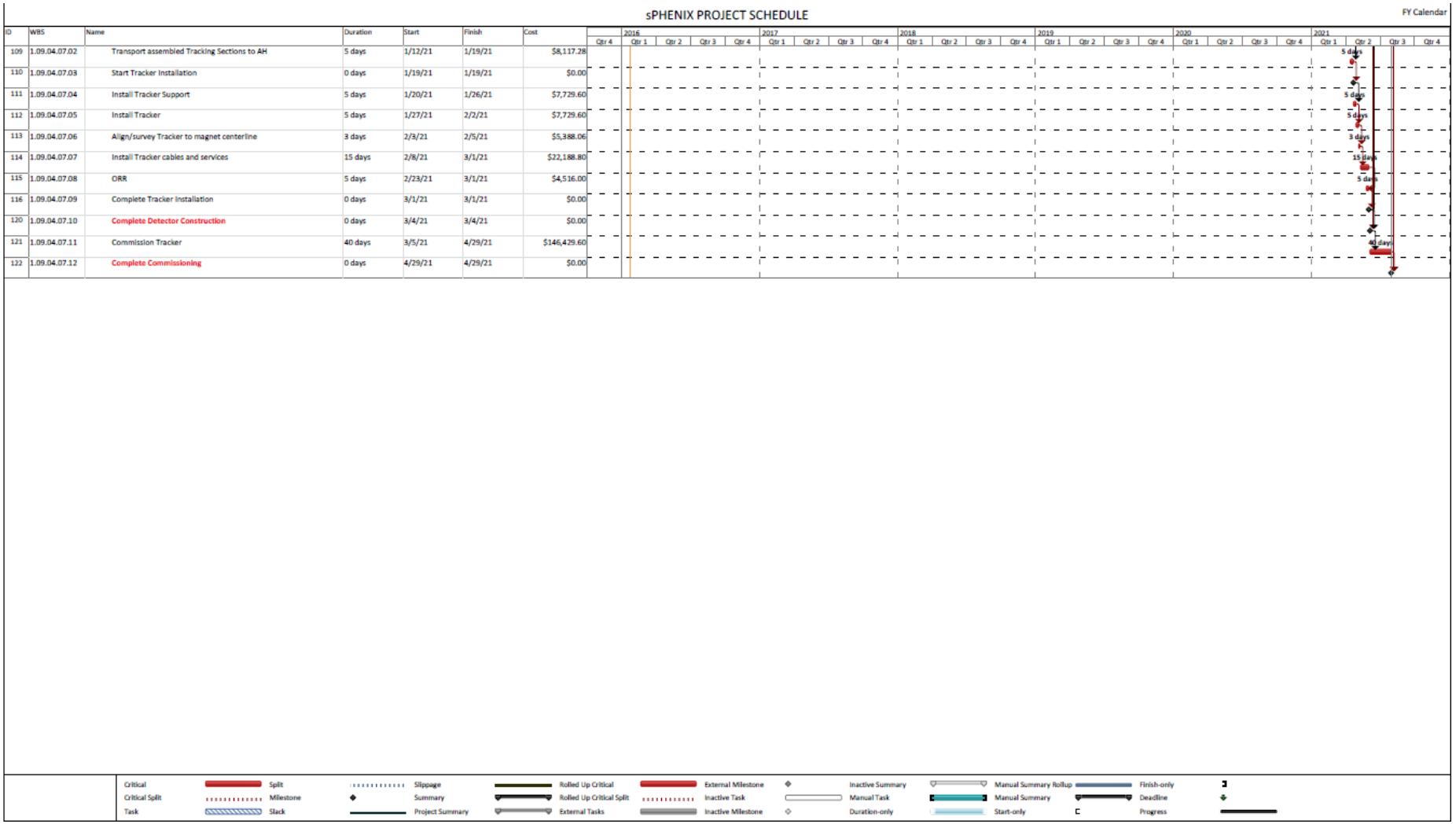
ID	WBS	Name	Duration	Start	Finish	Cost
155	1.3.3.3.1.21	Sensormodule S2 QA	265 days	3/1/19	3/23/20	$47,870
157	1.3.3.3.1.23	Assemble ladders S2	285 days	2/14/19	4/6/20	$116,482
158	1.3.3.3.1.24	Test ladders S2	285 days	2/22/19	4/13/20	$51,482
159	1.3.3.3.1.25	S2 Ladder transport to BNL	20 days	4/13/20	5/11/20	$4,613
162	**1.3.3.3.2**	**SiStrip layer production and assembly**	**595 days**	**6/28/18**	**11/16/20**	**$1,452,948**
170	1.3.3.3.2.8	S1 Ladder Testing at BNL	15 days	5/12/20	6/2/20	$7,576
171	1.3.3.3.2.9	S2 Ladder Testing at BNL	15 days	5/12/20	6/2/20	$12,576
174	1.3.3.3.2.12	S1 Barrel assembly	100 days	6/3/20	10/23/20	$156,168
175	1.3.3.3.2.13	S1 Testing	100 days	6/10/20	10/30/20	$31,040
176	1.3.3.3.2.14	S2 Barrel Assembly	100 days	6/3/20	10/23/20	$156,168
177	1.3.3.3.2.15	S2 Testing	100 days	6/10/20	10/30/20	$31,040
178	1.3.3.3.2.16	Assemble Layer Cooling Distribution	10 days	11/2/20	11/16/20	$16,782
179	1.3.3.3.2.17	Assemble Layer Power Distribution	10 days	11/2/20	11/16/20	$17,617
180	1.3.3.3.2.18	SiStrip Ready to Install	0 days	11/16/20	11/16/20	$0
397	**1.3.5**	**Final Tracker Assembly/Testing Integration**	**35 days**	**11/16/20**	**1/11/21**	**$64,418**
398	1.3.5.1	Start Tracker Assembly	0 days	11/16/20	11/16/20	$0
399	1.3.5.2	Install Pixel Detector	5 days	11/17/20	11/23/20	$7,974
400	1.3.5.3	Install 3 SI Barrels or TPC	5 days	11/24/20	12/2/20	$7,974
401	1.3.5.4	Integrate Inner and Outer Layers	5 days	12/3/20	12/9/20	$12,004
402	1.3.5.5	Cable and Plumb Final Detector Assembly	5 days	12/10/20	12/16/20	$9,294
403	1.3.5.6	Test and Debug Final Detector Assembly	10 days	12/17/20	1/4/21	$18,877
404	1.3.5.7	Prep Tracker for Installation	5 days	1/5/21	1/11/21	$8,294
9	**1.9**	**Install & Integration**	**1266 days**	**3/31/16**	**4/29/21**	**$2,816,170.88**
26	**1.09.04**	**sPHENIX Installation**	**664 days**	**8/28/18**	**4/29/21**	**$1,509,581.28**
39	**1.09.04.02**	**CP CarriageAssembly**	**455 days**	**5/20/19**	**3/19/21**	**$167,848.88**
49	1.09.04.02.08	Move Magnet Into IR (Final)	3 days	3/2/21	3/4/21	$8,035.92
70	**1.09.04.04**	**Outer HCal Installation**	**301 days**	**2/18/20**	**4/29/21**	**$338,168.68**
82	1.09.04.04.11	Commission Outer HCal	40 days	3/5/21	4/29/21	$94,621.60
83	**1.09.04.05**	**Inner HCal Installation**	**420 days**	**8/22/19**	**4/29/21**	**$197,036.86**
94	1.09.04.05.10	Commission Inner HCal	40 days	3/5/21	4/29/21	$94,621.60
95	**1.09.04.06**	**EMCal Installation**	**153 days**	**9/16/20**	**4/29/21**	**$221,691.38**
105	1.09.04.06.09	Commission EMCal	40 days	3/5/21	4/29/21	$133,501.60
106	**1.09.04.07**	**Tracking Installation**	**76 days**	**1/11/21**	**4/29/21**	**$202,098.94**
108	1.09.04.07.01	Tracking Sections assembled and Tested Ready to Ship to AH	0 days	1/11/21	1/11/21	$0.00



Critical, Critical Split, Task, Split, Milestone, Slack, Slippage, Summary, Project Summary, Rolled Up Critical, Rolled Up Critical Split, External Tasks, External Milestone, Inactive Task, Inactive Milestone, Inactive Summary, Manual Task, Duration-only, Manual Summary Rollup, Manual Summary, Start-only, Finish-only, Deadline, Progress

sPHENIX Design, Production, Commissioning 3 10/23/15

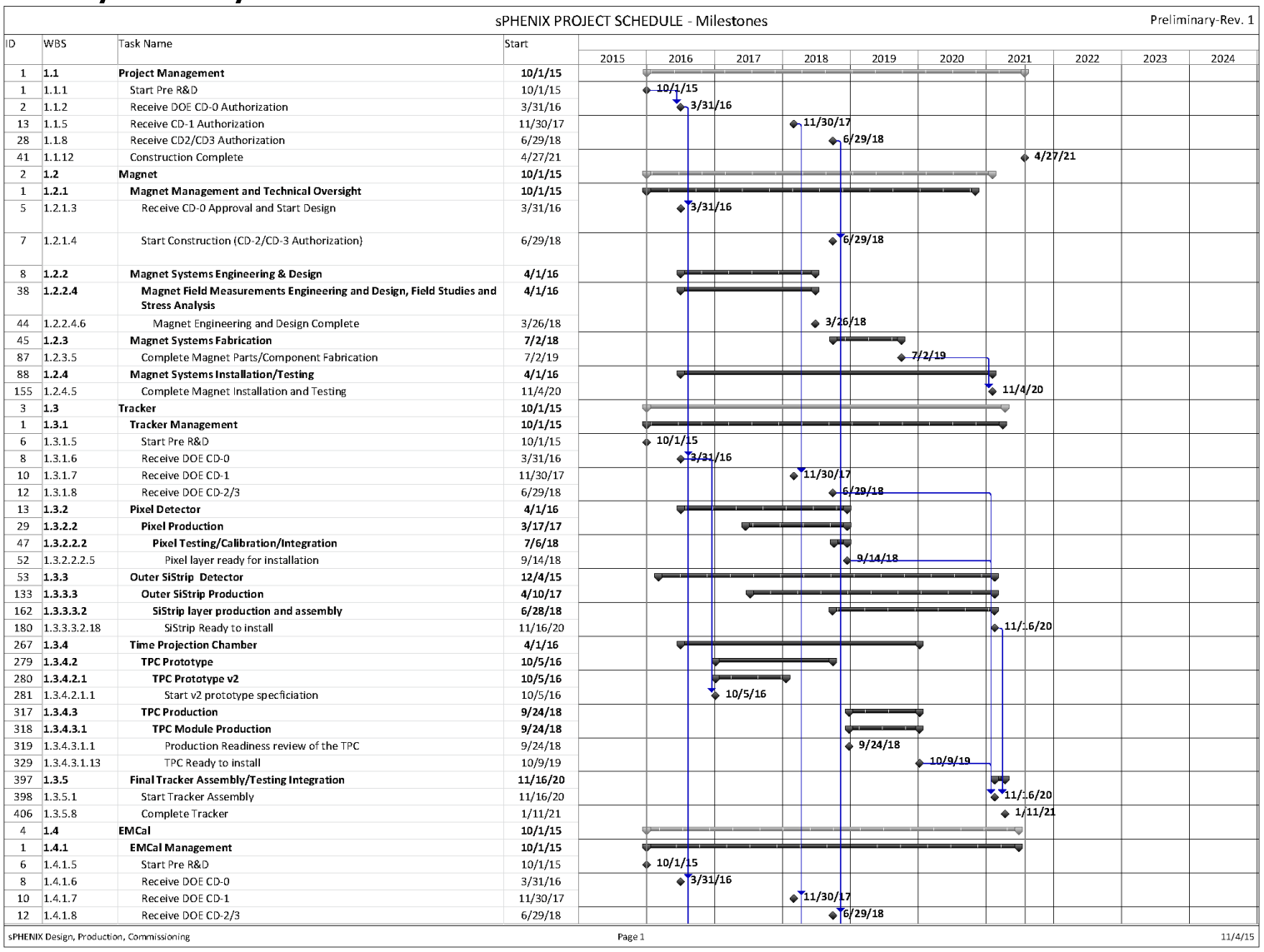
Critical Path



ID	WBS	Name	Duration	Start	Finish	Cost
109	1.09.04.07.02	Transport assembled Tracking Sections to AH	5 days	1/12/21	1/19/21	$8,117.28
110	1.09.04.07.03	Start Tracker Installation	0 days	1/19/21	1/19/21	$0.00
111	1.09.04.07.04	Install Tracker Support	5 days	1/20/21	1/26/21	$7,729.60
112	1.09.04.07.05	Install Tracker	5 days	1/27/21	2/2/21	$7,729.60
113	1.09.04.07.06	Align/survey Tracker to magnet centerline	3 days	2/3/21	2/5/21	$5,388.06
114	1.09.04.07.07	Install Tracker cables and services	15 days	2/8/21	3/1/21	$22,188.80
115	1.09.04.07.08	ORR	5 days	2/23/21	3/1/21	$4,516.00
116	1.09.04.07.09	Complete Tracker Installation	0 days	3/1/21	3/1/21	$0.00
120	1.09.04.07.10	Complete Detector Construction	0 days	3/4/21	3/4/21	$0.00
121	1.09.04.07.11	Commission Tracker	40 days	3/5/21	4/29/21	$146,429.60
122	1.09.04.07.12	Complete Commissioning	0 days	4/29/21	4/29/21	$0.00

Project Schedule Documentation

- Preliminary Subsystem Milestones



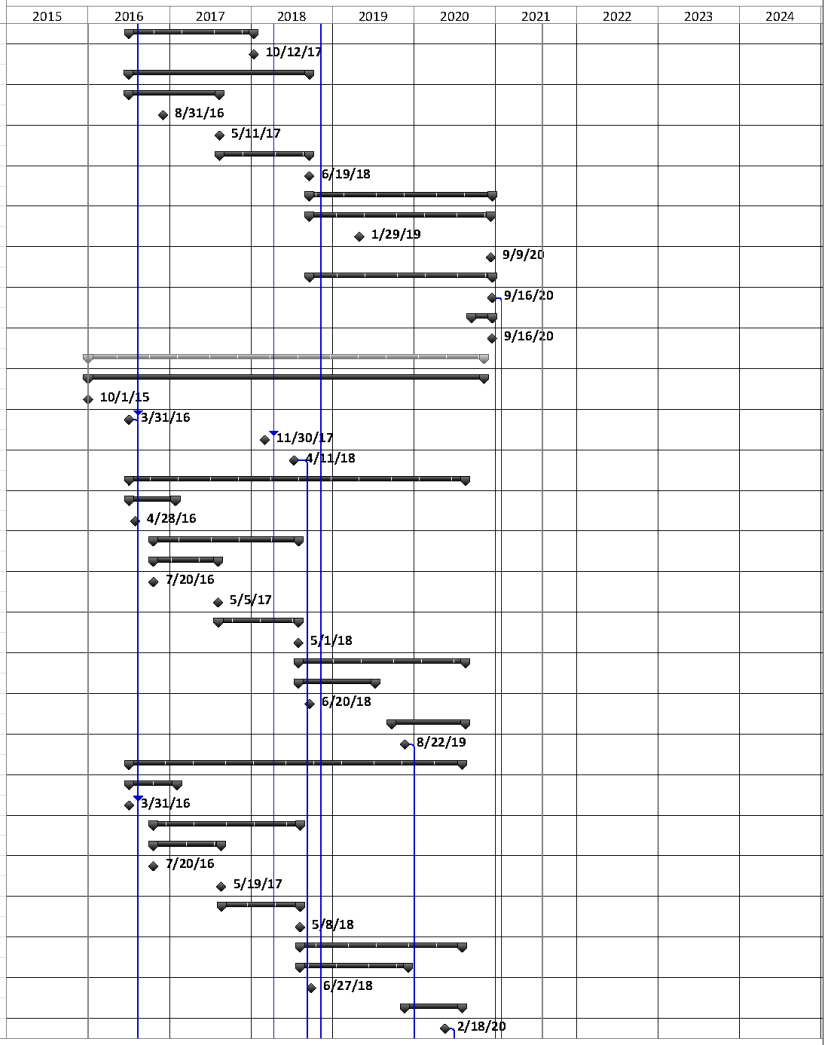
ID	WBS	Task Name	Start
1	**1.1**	**Project Management**	**10/1/15**
1	1.1.1	Start Pre R&D	10/1/15
2	1.1.2	Receive DOE CD-0 Authorization	3/31/16
13	1.1.5	Receive CD-1 Authorization	11/30/17
28	1.1.8	Receive CD2/CD3 Authorization	6/29/18
41	1.1.12	Construction Complete	4/27/21
2	**1.2**	**Magnet**	**10/1/15**
1	**1.2.1**	**Magnet Management and Technical Oversight**	**10/1/15**
5	1.2.1.3	Receive CD-0 Approval and Start Design	3/31/16
7	1.2.1.4	Start Construction (CD-2/CD-3 Authorization)	6/29/18
8	**1.2.2**	**Magnet Systems Engineering & Design**	**4/1/16**
38	**1.2.2.4**	**Magnet Field Measurements Engineering and Design, Field Studies and Stress Analysis**	**4/1/16**
44	1.2.2.4.6	Magnet Engineering and Design Complete	3/26/18
45	**1.2.3**	**Magnet Systems Fabrication**	**7/2/18**
87	1.2.3.5	Complete Magnet Parts/Component Fabrication	7/2/19
88	**1.2.4**	**Magnet Systems Installation/Testing**	**4/1/16**
155	1.2.4.5	Complete Magnet Installation and Testing	11/4/20
3	**1.3**	**Tracker**	**10/1/15**
1	**1.3.1**	**Tracker Management**	**10/1/15**
6	1.3.1.5	Start Pre R&D	10/1/15
8	1.3.1.6	Receive DOE CD-0	3/31/16
10	1.3.1.7	Receive DOE CD-1	11/30/17
12	1.3.1.8	Receive DOE CD-2/3	6/29/18
13	**1.3.2**	**Pixel Detector**	**4/1/16**
29	**1.3.2.2**	**Pixel Production**	**3/17/17**
47	**1.3.2.2.2**	**Pixel Testing/Calibration/Integration**	**7/6/18**
52	1.3.2.2.2.5	Pixel layer ready for installation	9/14/18
53	**1.3.3**	**Outer SiStrip Detector**	**12/4/15**
133	**1.3.3.3**	**Outer SiStrip Production**	**4/10/17**
162	**1.3.3.3.2**	**SiStrip layer production and assembly**	**6/28/18**
180	1.3.3.3.2.18	SiStrip Ready to install	11/16/20
267	**1.3.4**	**Time Projection Chamber**	**4/1/16**
279	**1.3.4.2**	**TPC Prototype**	**10/5/16**
280	**1.3.4.2.1**	**TPC Prototype v2**	**10/5/16**
281	1.3.4.2.1.1	Start v2 prototype specficiation	10/5/16
317	**1.3.4.3**	**TPC Production**	**9/24/18**
318	**1.3.4.3.1**	**TPC Module Production**	**9/24/18**
319	1.3.4.3.1.1	Production Readiness review of the TPC	9/24/18
329	1.3.4.3.1.13	TPC Ready to install	10/9/19
397	**1.3.5**	**Final Tracker Assembly/Testing Integration**	**11/16/20**
398	1.3.5.1	Start Tracker Assembly	11/16/20
406	1.3.5.8	Complete Tracker	1/11/21
4	**1.4**	**EMCal**	**10/1/15**
1	**1.4.1**	**EMCal Management**	**10/1/15**
6	1.4.1.5	Start Pre R&D	10/1/15
8	1.4.1.6	Receive DOE CD-0	3/31/16
10	1.4.1.7	Receive DOE CD-1	11/30/17
12	1.4.1.8	Receive DOE CD-2/3	6/29/18

Project Schedule Documentation

- Preliminary Subsystem Milestones

sPHENIX PROJECT SCHEDULE - Milestones — Preliminary-Rev. 1

ID	WBS	Task Name	Start
13	**1.4.2**	**EMCal Design**	**4/1/16**
21	1.4.2.8	Complete Design	10/12/17
22	**1.4.3**	**EMCal Prototype**	**3/31/16**
23	**1.4.3.1**	**EMCal Prototype v2**	**3/31/16**
24	1.4.3.1.1	EMCal Prototype v1 work complete	8/31/16
37	1.4.3.1.14	Complete v2 Prototype Work	5/11/17
38	**1.4.3.2**	**EMCal Preproduction Prototype**	**5/12/17**
67	1.4.3.2.29	Complete Preproduction Prototype Work	6/19/18
68	**1.4.4**	**EMCal Production**	**6/20/18**
69	**1.4.4.1**	**EMCal Tower/Module Production**	**6/20/18**
76	1.4.4.1.7	Start Module Fabrication	1/29/19
80	1.4.4.1.11	EMCal Module Production Complete	9/9/20
81	**1.4.4.2**	**EMCal Module/Sector Assembly**	**6/20/18**
97	1.4.4.2.14	Complete Production and Assembly	9/16/20
99	**1.4.4.3**	**EMCal Module Testing/Calibration/Integration**	**6/16/20**
101	1.4.4.3.3	Complete EMCal Subsystem, Ready for Installation	9/16/20
5	**1.5**	**HCal**	**10/1/15**
1	**1.5.1**	**HCAL management**	**10/1/15**
5	1.5.1.4	Start Pre R&D	10/1/15
7	1.5.1.5	Receive DOE CD-0	3/31/16
9	1.5.1.6	Receive DOE CD-1	11/30/17
11	1.5.1.7	Receive DOE CD-2/3	4/11/18
13	**1.5.2**	**Inner HCAL**	**4/1/16**
14	**1.5.2.1**	**Inner HCAL design**	**4/1/16**
16	1.5.2.1.2	Start Inner HCAL Design	4/28/16
27	**1.5.2.2**	**Inner HCAL prototype**	**7/20/16**
28	**1.5.2.2.1**	**Inner HCAL prototype v2**	**7/20/16**
29	1.5.2.2.1.1	Inner HCAL prototype v1 work complete	7/20/16
39	1.5.2.2.1.10	Complete Inner HCAL v2 prototype work	5/5/17
40	**1.5.2.2.2**	**Inner HCAL preproduction prototype**	**5/8/17**
50	1.5.2.2.2.9	Complete Inner HCAL Prototype and Start Production	5/1/18
51	**1.5.2.3**	**Inner HCAL production**	**5/2/18**
52	**1.5.2.3.1**	**Inner HCAL module production**	**5/2/18**
55	1.5.2.3.1.3	Design Complete Inner HCAL	6/20/18
68	**1.5.2.3.3**	**Inner HCAL module testing/calibration/integration**	**6/24/19**
73	1.5.2.3.3.5	Inner HCAL Ready for Installation	8/22/19
76	**1.5.3**	**Outer HCAL**	**3/31/16**
77	**1.5.3.1**	**Outer HCAL design**	**3/31/16**
78	1.5.3.1.1	Start Outer HCAL Design	3/31/16
90	**1.5.3.2**	**Outer HCAL prototype**	**7/20/16**
91	**1.5.3.2.1**	**Outer HCAL prototype v2**	**7/20/16**
92	1.5.3.2.1.1	Outer HCAL prototype v1 work complete	7/20/16
102	1.5.3.2.1.10	Complete V2 Prototype Work	5/19/17
103	**1.5.3.2.2**	**Outer HCAL preproduction prototype**	**5/22/17**
114	1.5.3.2.2.9	Compete Outer HCAL Prototype Work	5/8/18
115	**1.5.3.3**	**Outer HCAL production**	**5/9/18**
116	**1.5.3.3.1**	**Outer HCAL module production**	**5/9/18**
119	1.5.3.3.1.3	Outer HCAL Design Complete	6/27/18
135	**1.5.3.3.3**	**Outer HCAL module testing/calibration/integration**	**8/21/19**
140	1.5.3.3.3.5	Outer HCAL Ready for Installation	2/18/20



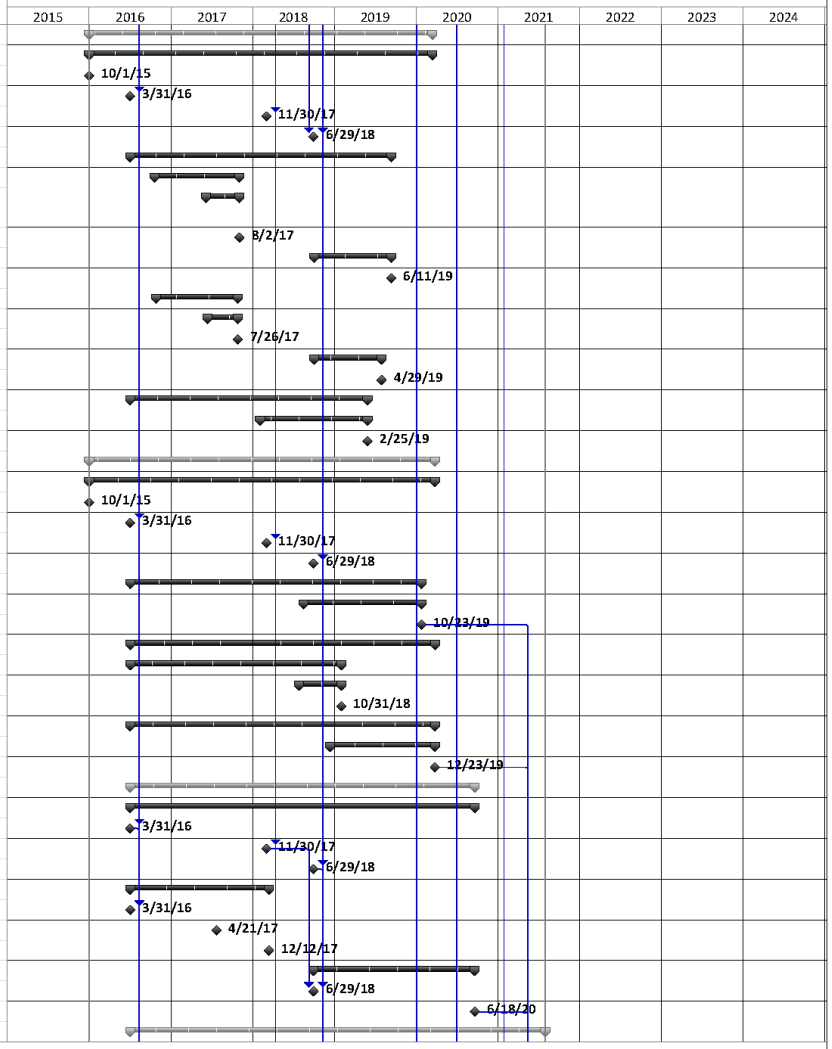
sPHENIX Design, Production, Commissioning — Page 2 — 11/4/15

Project Schedule Documentation

- Preliminary Subsystem Milestones

sPHENIX PROJECT SCHEDULE - Milestones — Preliminary-Rev. 1

ID	WBS	Task Name	Start
6	**1.6**	**Calorimeter Electronics**	**10/1/15**
1	**1.6.1**	**CalElectronics Management**	**10/1/15**
6	1.6.1.5	Start Pre R&D	10/1/15
8	1.6.1.6	Receive DOE CD-0	3/31/16
10	1.6.1.7	Receive DOE CD-1	11/30/17
13	1.6.1.8	Receive DOE CD-2/3	6/29/18
51	**1.6.3**	**Calorimeter on detector electronics**	**4/1/16**
80	**1.6.3.2**	**EMCal on detector electronics prototype**	**7/20/16**
86	**1.6.3.2.2**	**EMCal on detector prototype electronics preproduction prototype**	**3/6/17**
92	1.6.3.2.2.6	EMCal Preproduction Prototype Testing Complete	8/2/17
93	**1.6.3.3**	**EMCal on detector electronics production**	**7/2/18**
100	1.6.3.3.6	All On Detector Electronics Complete	6/11/19
126	**1.6.3.5**	**HCal on detector electronics prototyping**	**7/27/16**
134	**1.6.3.5.2**	**HCal on detector electronics preproduction prototype**	**3/13/17**
142	1.6.3.5.2.6	Hcal on Detector electronics preproduction prototype complete	7/26/17
144	**1.6.3.6**	**HCal on detector electronics production**	**7/2/18**
151	1.6.3.6.6	Hcal on-detector electronics complete	4/29/19
153	**1.6.4**	**Calorimeter digitizer system**	**4/1/16**
189	**1.6.4.3**	**Calorimeter digitizer production**	**11/3/17**
194	1.6.4.3.5	Complete Calorimeter Electronics	2/25/19
7	**1.7**	**DAQ&Trigger**	**10/1/15**
1	**1.7.1**	**Project oversight and Management**	**10/1/15**
5	1.7.1.4	Start Pre R&D	10/1/15
7	1.7.1.5	Receive DOE CD-0	3/31/16
9	1.7.1.6	Receive DOE CD-1	11/30/17
11	1.7.1.7	Receive DOE CD-2/3	6/29/18
12	**1.7.2**	**DAQ**	**4/1/16**
26	**1.7.2.3**	**DAQ Production**	**5/16/18**
43	1.7.2.3.17	DAQ Ready for Operation	10/23/19
45	**1.7.3**	**Trigger**	**4/1/16**
46	**1.7.3.1**	**Trigger LL1**	**4/1/16**
82	**1.7.3.1.3**	**Trigger LL1 Production**	**4/25/18**
89	1.7.3.1.3.7	Trigger LL1 ready for operation	10/31/18
90	**1.7.3.2**	**Trigger: MB Detector**	**4/1/16**
105	**1.7.3.2.3**	**Trigger: MB Detector Production**	**9/11/18**
111	1.7.3.2.3.6	MB Detector ready for installation	12/23/19
8	**1.8**	**Infrastructure**	**3/31/16**
1	**1.08.01**	**Project Management and Oversight**	**3/31/16**
5	1.08.01.3	CD-0 Approval: Start Project	3/31/16
7	1.08.01.4	CD-1 Approval: Start Final Design	11/30/17
9	1.08.01.5	CD-2/3 Approval: Construction Start	6/29/18
10	**1.08.02**	**Infrastructure Design**	**3/31/16**
11	1.08.02.1	Start Infrastructure Design	3/31/16
14	1.08.02.4	Complete Mechanical Support Structure Design	4/21/17
24	1.08.02.14	Complet Infrastructure Design	12/12/17
25	1.08.03	Infrastructure System Production	6/29/18
26	1.08.03.1	Start Infrastructure Procurement	6/29/18
47	1.08.03.12	Infrastructure Production Complete	6/18/20
9	**1.9**	**Install & Integration**	**3/31/16**



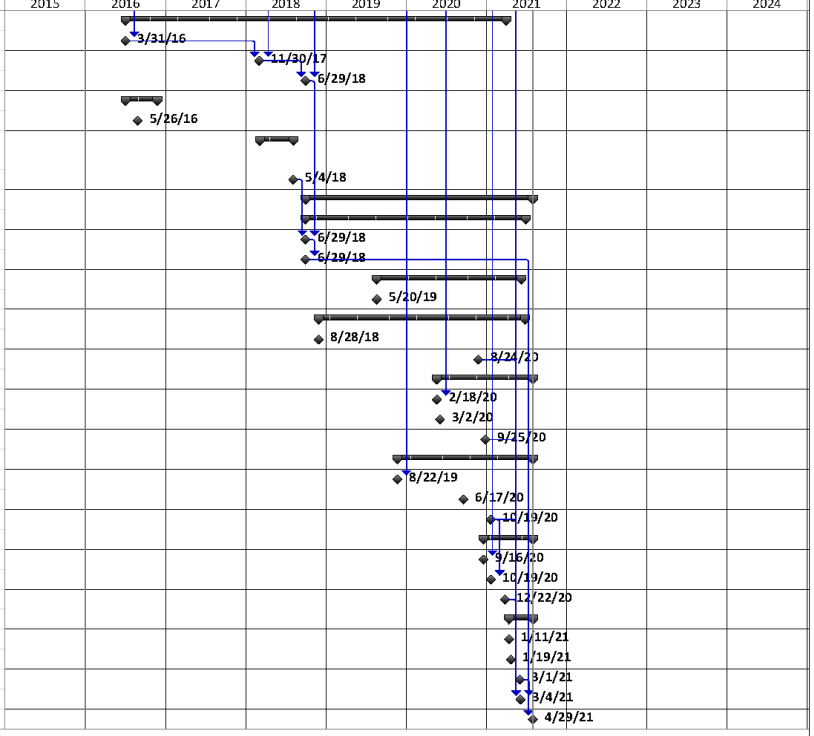
sPHENIX Design, Production, Commissioning — Page 3 — 11/4/15

Project Schedule Documentation

- Preliminary Subsystem Milestones

sPHENIX PROJECT SCHEDULE - Milestones — Preliminary-Rev. 1

ID	WBS	Task Name	Start
1	**1.09.01**	**Integration Supervision**	**3/31/16**
5	1.09.01.3	CD-0 Approval: Start Project	3/31/16
7	1.09.01.4	CD-1 Approval: Start Final Design	11/30/17
9	1.09.01.5	CD-2/3 Approval: Construction Start	6/29/18
10	**1.09.02**	**Integration Management and Technical Coordination**	**4/1/16**
15	1.09.02.5	sPHENIX Overall Design Concept Complete	5/26/16
18	**1.09.03**	**Integration/Installation Tooling/Fixture/Procedures Design and Production**	**12/4/17**
25	1.09.03.07	Complete Procedure Development and Approvals	5/4/18
26	**1.09.04**	**sPHENIX Installation**	**6/29/18**
27	**1.09.04.01**	**Infrastructure Installation**	**6/29/18**
28	1.09.04.01.01	CD 2/3 Approval: Start Construction	6/29/18
38	1.09.04.01.11	Complete Non-Carriage Infrastructure Installation	6/29/18
39	**1.09.04.02**	**CP CarriageAssembly**	**5/20/19**
41	1.09.04.02.01	Carriage Components Ready for Assembly	5/20/19
52	**1.09.04.03**	**sPHENIX SC Magnet Installation**	**8/28/18**
54	**1.09.04.03.1**	**Magnet Testing in 912 concluded, Magnet ready to ship to AH**	**8/28/18**
67	1.09.04.03.10	Complete Field Testing	8/24/20
70	**1.09.04.04**	**Outer HCal Installation**	**2/18/20**
72	1.09.04.04.01	Sectors Assembled and tested ready to ship to AH	2/18/20
74	1.09.04.04.03	Start Installation of Hcal	3/2/20
81	1.09.04.04.10	Installation of Outer HCAL Complete	9/25/20
83	**1.09.04.05**	**Inner HCal Installation**	**8/22/19**
85	1.09.04.05.01	Sectors Assembled and tested ready to ship to AH	8/22/19
87	1.09.04.05.03	Start Inner HCal Assembly	6/17/20
93	1.09.04.05.09	Installation of Inner HCAL Complete	10/19/20
95	1.09.04.06	EMCal Installation	9/16/20
97	1.09.04.06.01	EMCal Sectors assembled and Tested Ready to Ship to AH	9/16/20
99	1.09.04.06.03	Start EMCal Installation	10/19/20
104	1.09.04.06.08	Complete Installation of EMCal	12/22/20
106	1.09.04.07	Tracking Installation	1/11/21
108	1.09.04.07.01	Tracking Sections assembled and Tested Ready to Ship to AH	1/11/21
110	1.09.04.07.03	Start Tracker Installation	1/19/21
116	1.09.04.07.09	Complete Tracker Installation	3/1/21
120	1.09.04.07.10	Complete Detector Construction	3/4/21
122	1.09.04.07.12	Complete Commissioning	4/29/21



sPHENIX Design, Production, Commissioning — Page 4 — 11/4/15